

Application Serial No: 10/825407
Responsive to the Office Action mailed on: March 9, 2007

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REMARKS

This is in response to the final Office Action mailed on March 9, 2007. No new matter is added. Claims 1-4, 6-8, 11 and 12 are pending, with claims 7 and 8 being withdrawn.

103(a) Rejections:

Claims 1-4, 6, 11 and 12 are rejected as being unpatentable over Balasmo (US Patent Publication No. 2003/031222). This rejection is traversed.

Claim 1 is directed to a semiconductor laser device that requires, among other features, a ratio between a stripe width at a front end face and a stripe width at a rear end face satisfies a relationship of $1 < (\text{the stripe width at the front end face}) / (\text{the stripe width at the rear end face}) < 2$. Claim 1 further requires that a region having the constant stripe width on the front end face side has a length of one-twentieth or shorter of a length of a resonator, and the region having the constant stripe width on the rear end face side has a length of one-twentieth or shorter of the length of the resonator. Thus, the region between the region having the constant stripe width on the front end face side and the region having the constant stripe width on the rear end face side (hereinafter referred to as the "taper region") is at least eighteen-twentieths or 90% or more of the length of the resonator. An advantage of these features is that scattering loss of laser light can be suppressed because the width of the taper region can be increased gradually from the width at the rear end face towards the width at the front end face (see page 10, lines 26-33). Claim 1 also requires that the stripe width at the rear end face is $1.4 \mu\text{m}$ or more and less than $2.0 \mu\text{m}$. An advantage of these features is that a low threshold value current and a high slope efficiency is realized. Also, a kink level during the continuous oscillation operation can be increased and a stable laser oscillation in the fundamental transverse mode can be realized up to the time of the high optical output operation while also preventing the generation of higher order modes (see page 8, line 15-page 9, line 29 and Table 1).

Balasmo does not teach or suggest these features. Balasmo is directed to a semiconductor laser element that connects to a single-mode optical fiber without using additional optics (see paragraphs [0001], [0015] and [0067]). As Balasmo notes,

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"geometrical dimensions have to be carefully determined in order to obtain lasing at high power without degradation of the electro-optic performances of the structure."

Accordingly, Balasmo requires that the stripe width (W1) on the rear end face be between 5 and 11 μm (see paragraph [0068]). Therefore, the reference specifically teaches away from the feature of claim 1, that the stripe width at the rear end face is 1.4 μm or more and less than 2.0 μm . Moreover, as the geometrical dimensions in Balasmo have been carefully determined to obtain its semiconductor laser element, the reference provides no motivation to modify its chosen range to the range required by claim 1.

Balasmo also requires that the length (L1) of the region (106) having a constant stripe width (W1) on the rear end face not be greater than or equal to .8L (see paragraph [0026]). Setting $L1 < .8L$, Balasmo prevents an increase of light intensity only at a center part of the front end face by making the single mode region (106) not too long. Thus, high peak power densities due to the narrow width of the single mode region can be avoided (see paragraph [0077]). When the single mode region (106) is too long, the light intensity only at the center part of the front end face is too strong. Thus this aspect of Balasmo discloses the need to eliminate all values of L1 greater than or equal to .8L, and does not disclose that all values less than .8L would be expected to be useful.

Balasmo also teaches that $L1 > .4L$ and that L1 be sufficiently long in order to effectively eliminate higher order modes. The reference teaches that the optical mode characteristics will become unstable if the length (L1) of the region having a constant stripe width on the rear end face is less than or equal to .4L (see paragraphs [0069-0071] and Figures 6A, 6B, 7A and 7B). Therefore the reference specifically teaches away from the modification, $L1 \leq .05L$ required to obtain the invention of claim 1 and does not teach or suggest a functional semiconductor laser element that prevents the generation of higher order modes with $L1 \leq .05L$.

Furthermore, the advantages obtained using the features of claim 1 cannot be achieved with Balasmo. If length (L1) is greater than .4L, stable laser oscillation in the fundamental transverse mode can be achieved, but as a result the ratio of L2 and L1 will not satisfy the relationship of claim 1, $1 < (\text{the stripe width at the front end face}) / (\text{the stripe width at the rear end face}) < 2$. Accordingly, L2 is .6L or less, not .9L or more as required by the features of claim 1, thus causing a scattering loss of the laser light. If

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length (L1) is less than .4L, as taught away from in Balasmo, scattering loss of the laser light can be prevented. However, the optical mode characteristics of the device will become unstable at the fundamental transverse mode because the width (W1) is between 5 and 11 μm and not the range 1.4 μm or more and less than 2.0 μm required by stripe width at the rear end face of claim 1 (see paragraphs[0069-0071] and Figures 6A, 6B, 7A and 7B). Accordingly, there is no teaching, suggestion or motivation to modify the features of Balasmo with the features of claim 1. Moreover, the features of claim 1 are not merely a simple optimization of Balasmo, as widths and lengths of multiple regions of a semiconductor device need to be modified simultaneously away from the strict teachings of Balasmo to achieve the semiconductor laser device of claim 1. For at least these reasons claim 1 is not suggested by Balasmo and should be allowed. Claims 2-4, 6, 11 and 12 depend from claim 1 and should be allowed for at least the same reasons.

Conclusion:

Applicants respectfully assert claims 1-4, 6, 11 and 12 are in condition for allowance. Claims 7 and 8 should be reinstated for allowance with the remaining claims. If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Douglas P. Mueller (Reg. No. 30,300), at (612) 455-3804.



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